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MATHEMATICAL MODELING OF RISK ASSESSMENT OF ENTERPRISE MANAGEMENT

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Abstract. The article considers the issues of selection and use of management tools and methods, development and selection of enterprise strategy taking into account risks. The author's understanding of the risk management process is given, the basic principles that guide the development and implementation of risk management strategy at the enterprise are listed. The development of a risk assessment algorithm is proposed and the features of individual elements of the integrated risk assessment flowchart are characterized. In the paper, attention was drawn to the differences in the qualitative and quantitative risk analysis, the peculiarities of their methodology were determined. Considerable attention is paid to the definition of risk assessment methods, methods of risk minimization are listed, and as a result, the definition of the term "risk" is generalized. The methods of formation of enterprise strategy, which can be represented by three groups: portfolio analysis methods, mathematical methods, forecasting methods, are investigated. It is determined that modern methods of enterprise management and mechanisms for making key decisions in business imply the need to develop a procedure for both substantive and quantitative accounting and assessment of the entire range of possible uncertainties and risks that accompany the market activity of the enterprise. It is shown that most of the risks to be taken into account, quantified and accounted for in the economic and mathematical model of the enterprise, cover two main activities of the enterprise, and are integrated into the concept of risk management assessment: production and financial sphere. An economic and mathematical model of choosing the optimal strategy of the enterprise, taking into account the risk factors of management, according to the criterion of maximizing the amount of consolidated cash flow from operating and financial activities, which reflects both the production and technological conditions of the enterprise and the peculiarities of decision-making in the commodity and financial markets, is built. This optimization model is implemented to solve the problem of choosing the optimal management strategy taking into account management risks. However, all these methods start to work when the risk is realized (or must be realized) in losses and damages. Such an approach to building an effective risk management system does not comply with the principle of proactivity: it is not necessary to include in the cost estimate of the enterprise the costs of eliminating the consequences of the risk, it is necessary to include the costs of preventing the risk. With this approach, preventive and adequate measures can reduce the cost of risk, as well as choose the optimal level of risk, which is determined by the minimum cost. The results of the analysis show that most of the known methods of forecasting and risk assessment are inapplicable in conditions of unpredictability. The situation with the application of risk management tools is slightly better. Dissipation and insurance, as well as diversification of activities and the creation of funds and reserves are at least limitedly applicable. The presence of a risk assessment and coordination system at the enterprise will make it possible to identify existing risks, determine the level of danger and, using certain methods and tools of risk management, reduce their negative impact on the financial and economic activities of the enterprise. Currently, the approach to risk assessment is being transformed, as new challenges require fundamental changes in risk assessment and modeling systems.

Key words: uncertainty, risk, risk management system, risk management, evaluation model, mathematical modeling, enterprise strategy.

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1. Introduction

The modern stage of economic development of the enterprise is characterized by radical political, economic and social changes, as well as the rapid development of scientific and technological progress, which penetrates into all spheres of human life, enterprise and the country as a whole.

The growth of crisis phenomena, increasing dynamism and uncertainty of the economic situation requires from business entities to pay more attention to their own economic security, to identify and neutralize possible threats, risks and dangers that can adversely affect the state and results of their activities.

Many scientific publications of domestic and foreign authors are devoted to the problems of risk management in the enterprise and methods of mathematical modeling of risk assessment, in particular: J. M. Keynes, J. Mead, J. Neumann, V. V. Vitlinskyi, I. T. Balabanov, A. M. Dubrov, A. O. Starostina. But despite a significant number of scientific works devoted to this topic over the past 80 years, the problems of preventing or neutralizing the risks of management activities of enterprises remain ambiguous and unresolved. Although in most aspects the theoretical justification of risk management has already been developed, the issues of determining the structure of risk management and risk assessment of managerial decisions remain open. And if the production or monetary sphere has undergone gradual changes, then approaches to management, own management decisions and decision-makers are changing turbulently and not always predictably, but this primarily affects financial indicators that can be measured, modeled and adjusted, so the issues of analysis and assessment of management risks will always be relevant and require constant research.

It should be noted that in order to neutralize any threats to economic security, enterprises should direct their efforts to create their own security system, which will create conditions for the effective functioning of the enterprise, achievement of its goals in conditions of fierce competition and significant risks, by timely identifying and neutralizing various risks.

The ineffectiveness of transformation processes in the economy of Ukraine, until 2022, when military operations began on a large area of the territory of Ukraine, could be explained by the lack of effective practical developments in risk management of enterprises.

As the business practice of the last three years has shown, when after the severe quarantine crisis due to COVID-19, and in 2022, when the war broke out in Ukraine, it was those enterprises that, as a result of forecasting, created and maintained their own risk protection system, even in the most difficult modern conditions, were able to remain operational.

At the moment, there is an urgent need to create a fundamentally new methodology for the formation of a risk management assessment system that can be adapted to the current realities of the Ukrainian economy.

The author aims to investigate methodological approaches to determining management risks and applied aspects of economic and mathematical modeling of the management risk assessment system and the formation of a model of optimal choice of scenario behavior of the enterprise in the conditions of management risk at the enterprise.

2. Methodological approaches to risk management

The author is of the opinion that risk management is a process of making management decisions that minimize the adverse impact of external and internal factors on the enterprise, as well as reduce losses caused by random events. Moreover, minimization of possible adverse impact is a priority task, the solution of which does not allow a situation to arise when the company faces financial losses and other damages. Thus, risk management should be considered in a broader sense than as one of the methods of financial management.

Risk management is based on the results of risk assessment, technical, technological and economic analysis of the potential and environment of the operating enterprise, as well as on the forecasting of the regulatory framework, economic and mathematical methods, marketing and other research. In addition, risk management includes the development of strategy and tactics.

Thus, risk is an economic category that characterizes the possibility of deviation of the actual state from the planned one under the influence of uncertainty in economic relations.

Modern economic literature on the theory of risks is characterized by ambiguity in the interpretation of the features, properties and elements of risk, in understanding its content, the correlation of objective and subjective sides.

Thus, in the development and implementation of management decisions to minimize the effects of uncertainty factors, the risk of getting a "first" or "second kind" error is formed.

The error of the "first kind" is the failure to achieve the planned performance indicators of the enterprise, which is expressed in the planned costs, but lack of income. The error of the "second kind" consists in exceeding the planned performance indicators of the enterprise, which is expressed in a disproportionate increase in costs compared to the growth of income.

The error of the "first kind" is formed as a result of changes in market conditions, and the error of the "second kind" is the result of unprofessionalism of the enterprise management system.

Modern approaches to solving problems related to the risk of economic activity do not fully reflect the role and importance of a person in the enterprise risk management system. Motivational, managerial, professional qualification, socio-psychological, physio-logical risks caused by human participation in the production and economic activities of the enterprise are often the only real risks.

Thus, the risk determines the possibility of deviation, that is, the difference between the planned and the actual result of the decision, due to the presence of a certain number of restrictions of motivational, managerial, professional competence, socio-psychological and physiological nature.

Thus, risk management is the modeling of the possibility of deviation, that is, the mismatch of the planned and actual results of the decision, due to the action of certain restrictions of motivational, managerial, professional competence, socio-psychological and physiological nature.

The main purpose of "risk analysis" is to establish the maximum permissible risk for a certain type of cases, and for the studied and known risk factors – the values of the maximum permissible risk values. Quantitative and qualitative are the two main types of risk analysis.

Based on the information obtained, qualitative and quantitative risk analysis is carried out. Figure 1 shows the procedures used in risk analysis.

The main specific feature of the qualitative approach in risk research is that firstly, the risks are identified, and then the consequences of the risk and the developed measures to combat them are costed.

Qualitative analysis should be carried out at the stage of business plan development. Quantitative analysis, which is based on the tools of probability theory and mathematical statistics, consists in the numerical dimension of the impact of changes in project risk factors on the change in project efficiency and is based on the basic version of the project business plan and qualitative analysis (Shymko, Hrybkova, 2009).

The main methods of qualitative analysis are given in Table 1, quantitative methods of analysis are presented in Table 2. Qualitative analysis is responsible for the identification of all possible risks, which determines the risk factors, the sequence of works, during which the risk arises, etc.

Quantitative analysis is responsible for identifying the amount of damage from various subtypes of risk, which identifies the causes, sources of risk and the magnitude of the likely consequences. In our opinion, it is the system of bankruptcy control and diagnostics that is close to the study and assessment of financial risks, since all similar financial and

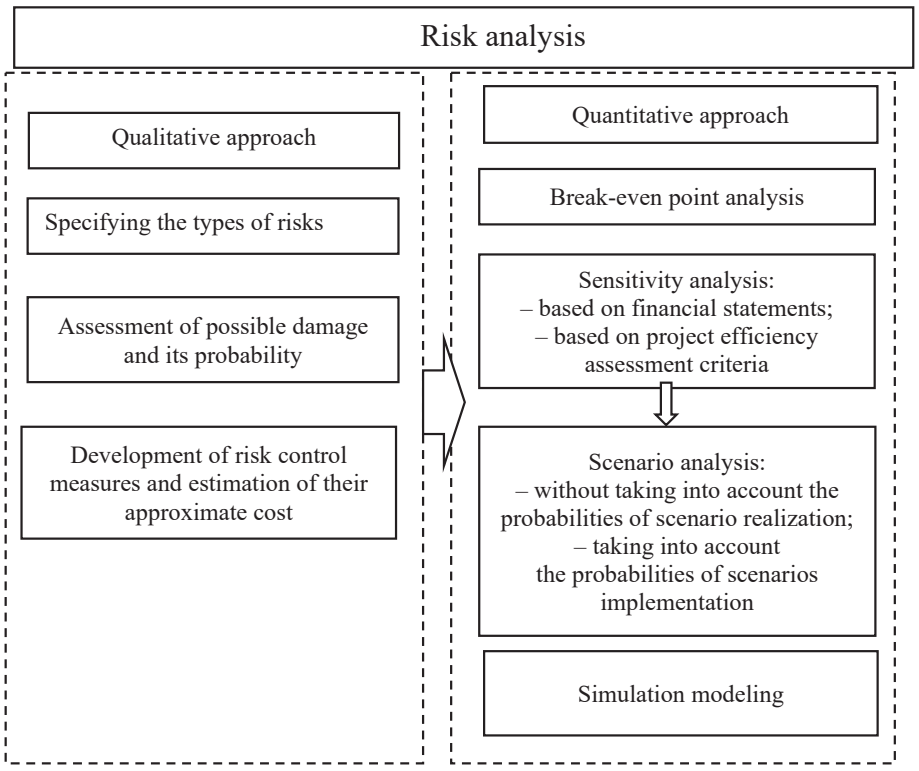

Figure 1. Risk analysis procedure

Table 1

Main qualitative and quantitative methods of analysis

Method	The essence of the method	Peculiarities of the method
Qualitative methods of risk analysis		
Specifying the types of risks	Involves the collection and detailed study of information about the future "project "* and its inherent risks	Requires time and financial costs to obtain information
The method of analogies	Provides for comparison of the future "project" with previously implemented "projects" by a number of features	Requires completeness of information to understand the degree of its applicability in a particular situation
Cause and effect analysis	It involves heuristic identification of risk events, formal logical analysis of their possible causes and development of anti-crisis measures	It is used at the pre-investment stage, stimulates the search for options to improve the reliability of the "project" as a whole
The event-consequence method	It involves dividing the "project" into elements and identifying risks for each of them	It is used to identify specific risks
Methods that combine quantitative and qualitative analysis		
The method of expert assessments	The central figure of this method is an expert who conducts the assessment using logical and mathematical – statistical methods	The advantage of this method is the absence of the need for accurate initial data and expensive software tools, to take into account the influence of various factors using the experience of an expert
Creating a risk profile or risk map	It involves assessing the risks of the "project" by a number of parameters and displaying them on a group of appropriate scales. The resulting "profile" is compared with the "reference"	It is a tool for visualizing the risk structure and assessing the project's compliance with the organization's risk policy

* Different types are meant (draft agreement, investment project, cooperation project, etc.)

economic indicators that determine the "health of the enterprise" are taken as a basis.

Currently, the most common are: two-factor model, Altman coefficients, Taffler's four-factor model, expert estimates, cost-effectiveness, analytics.

However, to assess the magnitude and probability of the risk, it is not enough to use only the mathematical apparatus determined by the set of the initial information flow.

The enterprise, in the course of its activities, may refuse to implement a particular risk-related decision, and these methods can be applied to significant risks both at the stage of preliminary processing of the decision and in the process of activity as a corrective action in case of unauthorized risk growth.

Today there are a large number of methods of risk minimization. The main ways of risk minimization

Table 2

Main quantitative methods of analysis

Method	The essence of the method	Features of the method
Adjustment of the norm discounting	Provides for an increase in the discount rate in accordance with the totality of risks affecting the "project"	Does not take into account changes in the level of risk during the implementation of the "project"
Reliable equivalents method	Provides for expert adjustment of cash flows depending on the subjective assessment of the level of risk associated with the receipt of these cash flows	The danger of the method is that there are no reasonable methods for calculating risk-free equivalents, as well as the subjectivity of expert assessment
Analysis of performance indicators and cash flow dynamics	Provides for consideration of the safety margin of the project, manifested by relative indicators	Provides only an aggregate assessment of all project risks
Sensitivity analysis	By making alternate single changes to the technical and economic parameters of the "project", the risks that most affect the project are identified	The method also allows to estimate the degree of deviation of the parameter at which the "project" becomes unprofitable
The method of scenarios	By simultaneously making changes to a number of technical and economic parameters, alternative to the basic scenario of the "project" development are formed	The use of this method, unlike sensitivity analysis, eliminates the limitation on the number of factors
Simulation modeling	Provides for the construction of a financial model and multiple calculation of "project" scenarios, calculated taking into account the correlation between its parameters	The method is difficult to use, requires the use of special software, as well as additional research

* Different types are meant (draft agreement, investment project, cooperation project, etc.)

are as follows: risk avoidance; risk distribution between participants; risk insurance; self-insurance; diversification; limitation; alternative planning; creation of a flexible production structure; creation of reserve funds; monitoring of information; education and training; application of flexible technologies.

Effective methods of risk management are risk allocation, funds reservation, hedging.

Thus, the use of methods to reduce the risks of enterprise activity allows to effectively assess the risk and increase the level of income and profit, but it requires a comprehensive and integrated assessment and reliable development forecasts.

3. Economic and mathematical modeling of the management risk assessment system

The article builds an economic and mathematical model for choosing the optimal development strategy, taking into account risk factors by the criterion of maximizing the amount of consolidated cash flow from operating and financial activities.

As a criterion function of the model, the market criterion is considered – the maximum consolidated cash flow for two interrelated areas of the enterprise's market activity: operational and financial.

The amount of consolidated cash flow should be adjusted for the amount of risk adjustment, which is interpreted as a possible loss or shortfall in profit (in value terms) due to the realization of a group of internal risks of the enterprise.

The limitations of the model for choosing the optimal strategy of the enterprise are supposed to be taken into account in the following groups: production and technological, financial and resource, market and risk.

The group of production and technological should include restrictions on the volume of specific assets of the enterprise, characterizing the existing operational and production capacities. In the constraints of this group, the traditional approach to the problems of modeling the production activity of the enterprise is used, focused on the accounting of the effective time fund of the main technological equipment (Irtishcheva, Stegney, Pauk, 2014).

The block of financial and resource constraints reflects the amount of the company's capital attracted to finance the above market activities.

The group of market constraints reflects the conditions for the sale of the company's commodity products in the developed market segments, as well as the possible volumes of credit resources attracted to market activities at the external borrowing rate set in the scenario.

For the formation of the first of the group of market constraints, the approach related to the binding of market demand for the commodity products of the enterprise to the planned price of its sale was used.

The second constraint from the market block is set based on the relationship between the volume of planned external borrowings and interest rates. It is assumed that the dependence under study is determined at the stage of scenario development.

The fourth block of restrictions establishes acceptable levels of risks in the production and financial sphere of the market activity of the enterprise, the characteristics of which are supposed to use the coefficients of return on equity (ROE) and autonomy (KA) (Shtefanich, 1999; Irtishcheva, Stegney, Pauk, 2014).

The value of the autonomy ratio coincides with the share of equity divided by total capital (the sum of equity and borrowed capital). Considering the absence of long-term borrowings planning at the enterprise in the short-term interval, we present the formula for calculating the autonomy ratio:

$$K_A^{(t)} = BK_{t-1} \Big/ BK_{t-1} + K_t \quad (1)$$

where BK(t-1) is equity at the end of period (t-1) – the beginning of planning period t,

Kt – is the amount of attracted short-term loans in the planning period t, which are expected to be repaid in the next period (t+1).

Taking into account the minimum standard value of the financial autonomy ratio, the planned range of its changes is determined (Irtishcheva, Stegney, Pauk, 2014):

$$0,5 \geq K_A^{(t)} \leq 1 \quad (2)$$

Based on formulas (1) and (2) the following is obtained:

$$0 \leq K_t \leq B\,K_{t-1} \quad (3)$$

Taking into account the restriction on the planned amount of K_t borrowed funds:

$$0 \leq K_t \leq S_t \quad (4)$$

where S_t – the maximum amount of credit resources available for the planning period t, the restriction on the amount of external borrowing is determined, which is initiated by the marginal value of the autonomy ratio and the credit rating of the borrower:

$$0 \leq K_t \leq M_t \quad (5)$$

M_t – upper limit on the amount of credit resources to be attracted:

$$M_t = min\,\{BK_{t-1};\, S_t\} \quad (6)$$

Also important is the problem of accounting in the enterprise model of the risk of market activity on the basis of the marginal value of the profitability ratio on the basis of the marginal value of the return on equity,

the formula for determining is presented in the form of formula (7) (Irtishcheva, Stegney, Pauk, 2014):

$$ROE_t = {2NP_t}/{2BK_{t-1}} + \Delta BK \quad (7)$$

where NP_t is the net profit for the planning period t;

ΔBK – increase in own funds for the planning period t (the amount of retained earnings for the planning period t).

The restriction on the ROE is represented by the following formula (8):

$$ROE_t \geq \widehat{ROE_t}$$

where $\widehat{ROE_t}$ is the marginal value of the return on equity for the planning period t.

The formalized description of the model of formation of the optimal strategy of the enterprise taking into account risk factors is presented.

The target function of the model is the maximum consolidated cash flow from operating and financial activities adjusted for the amount of risk expenses for the internal risk group.

According to Form 3 "Statement of Cash Flows", cash flow from operating activities OCF cash flow from operating activities (Vitlinskiy, Velikoivanenko, 2004):
1) revenues from: sale of products (goods, works, services); refund of taxes and fees; targeted financing; other revenues;
2) expenditures on payment for: goods (works, services); labor; contributions to social activities; liabilities on taxes and fees, other costs.

According to Form 3 "Statement of Cash Flows", cash flow from financing activities FCF cash flow from financing activities) (Vitlinskiy, Velikoivanenko, 2004):
1) income from: equity, loans, other income;
2) expenses for: redemption of own shares; repayment of loans; payment of dividends; other payments.

Excluding dividend payments to major shareholders (within the short-term planning period), cash flow is presented as the difference between revenue from sales of goods and total production costs of the enterprise, which includes interest on short-term loans:

$$OCF_t = (1-\delta_t)\left[\sum_{j=1}^{j}(p_j^{(t)} - c_j^{(t)})\right] y_j^{(t)} - F_t - \omega_t K_t] \quad (10)$$

where OSF_t – cash flow from operating activities for the planning period t;

δ is the income tax rate in the planning period t;

$p_j^{(t)}$ j=1,J – is the selling price of a unit of the j-th commodity in the planning period t;

$c_j^{(t)}$ j=1,J – is the variable cost per unit of the j-th product in the planning period t;

$y_j^{(t)}$ j=1,J – is the output of commodity product of j-th name in the planning period t;

F_t is the fixed cost of production in the planning period t;

ω_t is the interest rate on borrowed funds for the planning period t.

Thus OCF_t cash flow from operating activities of the enterprise for the planning period t coincides with the net profit of the NP for the same period.

The element composition of variables $c_j^{(t)}$ j=1,J, and constant F – production costs for an enterprise with serial production is determined.

Production costs Ct of operating activities include items of expenses for the implementation in the planning period of the main activities related to the production and sale of marketable products, which is given by the vector $Y = (y_1, y_2, \ldots, y_j, \ldots y_J)$.

Here is the elementary composition of cash flow from financing activities. Let us formulate the calculation formula for cash flow from financing activities, assuming that the issue of shares and the associated increase in equity capital in this short-term planning interval t is not carried out (11):

$$FCF_t = K_t - K_{t-1} \quad (11)$$

where FCF_t is the cash flow from financial activities of the enterprise for the planning period t.

K_{t-1} – is the amount of attracted short-term loans in the previous planning period t -1... which are repaid in the current period t.

Write down the objective function of the model using the described structure of the formation of the components of the consolidated cash flow (12).

$$CF_t = OCF_t + FCF_t - R_{t=}(1-\delta_t)\left[\sum_{j=1}^{J}(p_j^{(t)} - c_j^{(t)})\right] y_j^{(t)} -$$

$$- F_t - \omega_t K_t] + K_t - K_{t-1} - R_t \rightarrow max \quad (12)$$

CF_t is the consolidated cash flow from operating and financial activities for the planning period t, adjusted for the amount of the insurance reserve.

4. Formation of the model of optimal choice of scenario behavior of the enterprise in the conditions of risk management at the enterprise

Suppose that the block of risk constraints involves the use of inequality on the maximum available amount of resources Kt for the planning period t, taking into account the threshold value of the autonomy coefficient, which the decision maker determines. Then, the following formalization of the criterion function and the system of constraints of the model of forming the optimal variant of the enterprise strategy, taking into account the risk factors of the production, financial and managerial spheres, allows to present it in the following form (13):

$$CF_t = (1-\delta_t)\left[\sum_{j=1}^{J}(p_j^{(t)} - c_j^{(t)})\right] y_j^{(t)} - F_t - \omega_t K_t] +$$
$$+ K_t - K_{t-1} - R_t \to max \quad (13)$$

$$\sum_{j=1}^{J} = 1\tau_{j,h}^{(t)} y_j^{(t)} \le x_h^{(t)}, j = \overline{1,J}, h = \overline{1,H} \quad (14)$$

$$\sum_{j=1}^{J} = 1C_j^{(t)} y_j^{(t)} + F_t \le BOK_t + K_t \quad (15)$$

$$\hat{y}_j^{(t)} \le y_j^{(t)} \le D_j^{(t)}, j = \overline{1,J}; \quad (16)$$

$$0 \le K_t \le M_t$$

$$ROE_t \ge \widehat{ROE}_t$$

CF_t – is the consolidated cash flow from operations for the planning period t;

$p_j^{(t)}$ – is the selling price of a unit of the j-th commodity in the planning period t;

$c_j^{(t)}$ j=1,J – is the variable cost per unit of the j-th product in the planning period t;

$y_j^{(t)}$ j=1,J – is the output of commodity product of j-th name in the planning period t;

F_t – is the fixed cost of production in the planning period t;

ω_t – is the interest rate on borrowed funds for the planning period t.

K_t – is the amount of attracted short-term loans in the planning period t, which are expected to be repaid in the next period (t+1).

K_{t-1} – is the amount of attracted short-term loans in the previous planning period (t-1), which are repaid in the current period (t).

R_t – insurance reserves (belong to the section Equity).

$\tau_{j,h}^{(t)}$ – is the intensity of supply of the j-th product to the h-th group of technological equipment in the planning period t;

$x_h^{(t)}$, – is the effective operating time fund of the equipment of the h-th group in the planning period t;

BOK_t – own working capital of the enterprise at the beginning of the planning period;

$y_j^{(t)}$ – is the minimum allowable volume of products of the j-th item to be produced;

$D_j^{(t)}$ – is the market demand for the j-th product in the planning period t;

M_t – upper limit on the amount of attracted credit resources (determined on the basis of the financial autonomy ratio);

ROE_t – is the return on equity for the planning period t;

$\widehat{ROE}_t$ – is the threshold value of the ROE for the planning period t.

The values of the variables $\tau_{j,h}^{(t)}(j = \overline{1,J}, h = \overline{1,H})$, $C_j^{(t)}\left(J = \overline{1,J},\right)$, F_t, K_{t-1}, δ_t, R_t are determined by the technical, economic and financial conditions of the production strategy formation and are the determined values.

The values of the variables $\hat{y}_j^{(t)}$ $(j = \overline{1,J},)$, $x_h^{(t)}(h = \overline{1,H})$, BOK_{t-1}, M_t and the set of indices J and H are set at the stage of forming the list of alternative options for the production strategy by the decision maker.

The variables $p_j^{(t)}\left(j = \overline{1,J},\right)$, $D_j^{(t)}$ $(j = \overline{1,J},)$, ω_t, as well as the maximum available for the planning period t, the amount of credit resources is given by the scenario.

All these changes belong to the group of exogenous variables in our model.

The variables $y_j^{(t)}\left(j = \overline{1,J}\right)$, K_t constitute a block of endogenous factors and reflect the elemental composition of the strategy that is formed in the presented model.

Thus, the model (13)-(16) for choosing the optimal strategy of the enterprise is formed, which is reduced to the problem of integer linear programming.

5. Conclusions

Taking into account the modern understanding of the risk management process as part of the strategic management of the organization, it can be concluded that in a modern enterprise the risk management system should not just be as such, but organically integrated into the planning and management system of the enterprise.

The presence of a risk management system at the enterprise will make it possible to identify existing risks, determine the level of danger and, using certain methods and techniques of risk management, reduce their negative impact on the financial and economic activities of the enterprise. Currently, the approach to risk assessment is being transformed, because new challenges require fundamental changes. The above-mentioned ways to reduce risks allow enterprises to function more stably in the current conditions of the dynamically changing economy of Ukraine.

The results of the analysis show that most of the known methods of forecasting and risk assessment are inapplicable in conditions of unpredictability. The situation with the application of risk management tools is slightly better. Dissipation and insurance, as well as diversification of activities and creation of reserves, are at least limitedly applicable. Given these results of the study, however, it is impossible to conclude that risk assessment and management for the enterprise is useless: a significant proportion of events are not unpredictable, so integrated, systematic risk management gives the

company the opportunity to prevent them or be prepared for their occurrence. It is only necessary to understand the weak applicability of the considered methods in the conditions of unpredictability and to look for additional tools that would allow the enterprise to timely detect the occurrence of unforeseen events and quickly adapt to unexpectedly changed conditions.

However, all these methods start to work when the risk is realized (or must be realized) in losses and damages. Such an approach to building an effective risk management system does not comply with the principle of proactivity: it is not necessary to include in the cost estimate of the enterprise the costs of eliminating the consequences of the risk, it is necessary to include the costs of preventing the risk. With this approach, preventive and adequate measures can reduce the cost of risk, as well as choose the optimal level of risk, which is determined by the minimum cost.

The built models allow to make a timely choice of the development strategy of the organization in a rapidly changing business environment and do not require significant time, labor and financial resources.

For the development of the study of tasks related to the choice of the optimal development strategy, it will be relevant to develop a variant of the dynamic model of forming the optimal strategy of the enterprise, taking into account the risk factor of its internal and external environment. The need to develop such a model is dictated by the requirements of the formation of the enterprise strategy at least for the medium term, which takes into account the dynamic variability of its components.

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